



# TABOLETTA

FOR TABLUT CHALLENGE 2021

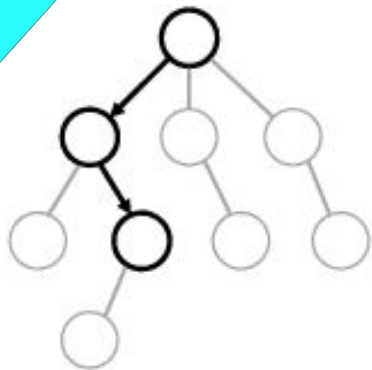
SIMONE MELE

VAIRO DI PASQUALE

DAVIDE BALDELLI

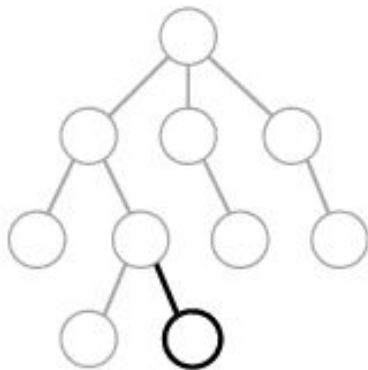
# MONTECARLO TREE SEARCH

SELECTION



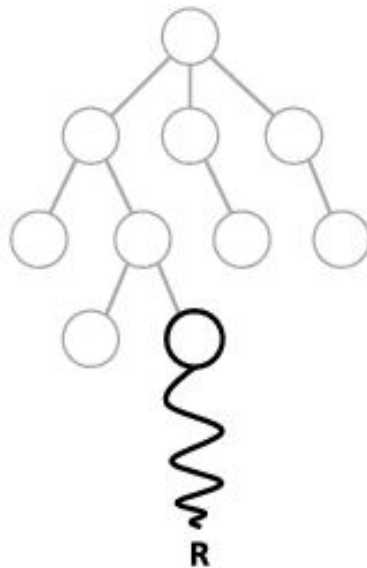
A selection policy is applied until a not fully expanded node is reached.

EXPANSION



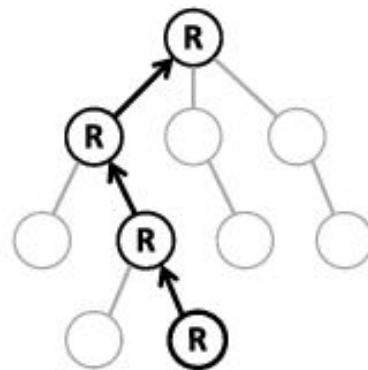
A new node is added to the selected one, choosing an action.

SIMULATION

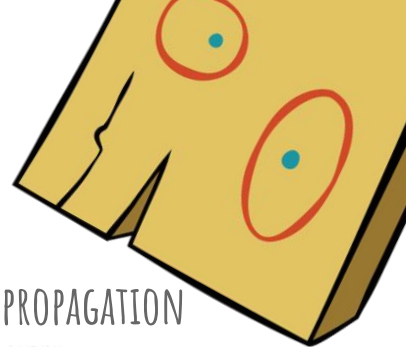


At each state one action is chosen until the end of the game.

BACKPROPAGATION



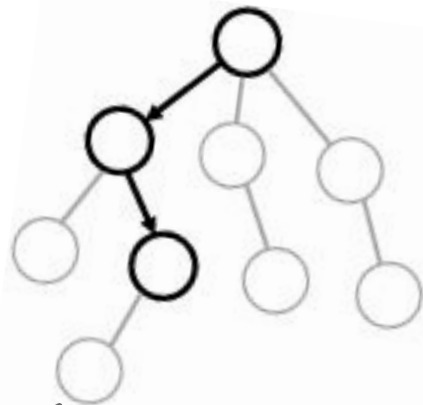
The result of the simulation is backpropagated in the tree.



# MCTS + MINMAX

## SELECTION

Starting from the root node, we go down the tree by repeatedly selecting the best move, based on the UCB1 score, and advancing to the corresponding child node until a not fully expanded node is reached.



**EXPLOITATION**

UCB1

$$Q(i) + c \sqrt{\frac{\log(N_i)}{n_i}}$$

**EXPLORATION**

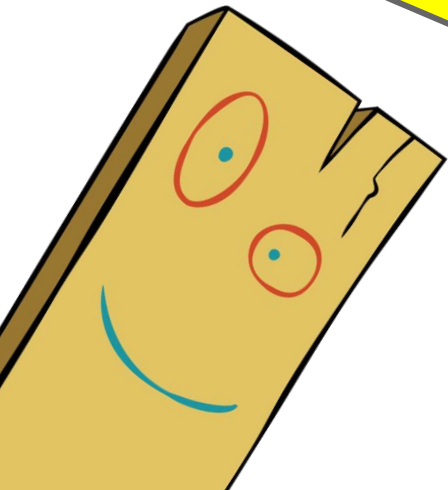
**MINMAX**

$$Q(i) = (1 - \alpha) \times \frac{w_i}{n_i} + \alpha h_i$$

**MCTS**

PARAMETERS:

$$c = \sqrt{2} \quad \alpha = 0.7$$

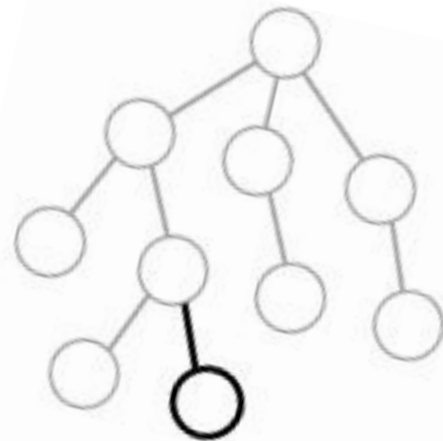


# MCTS + MINMAX

## EXPANSION

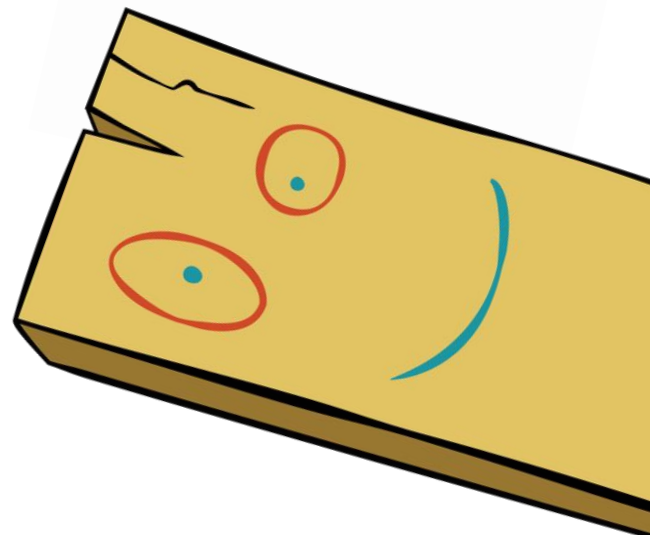
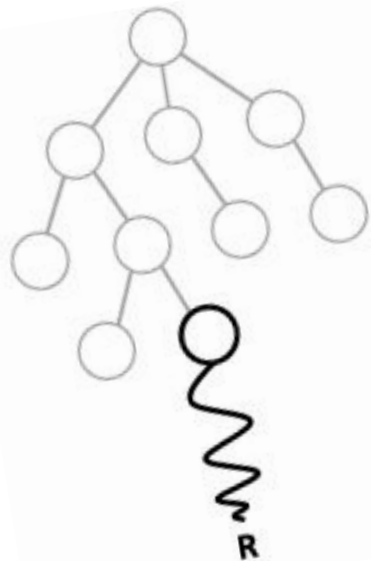
Given the selected node, one unexpanded move is randomly chosen and the corresponding node is added.

Here, we evaluate the new state using heuristics.

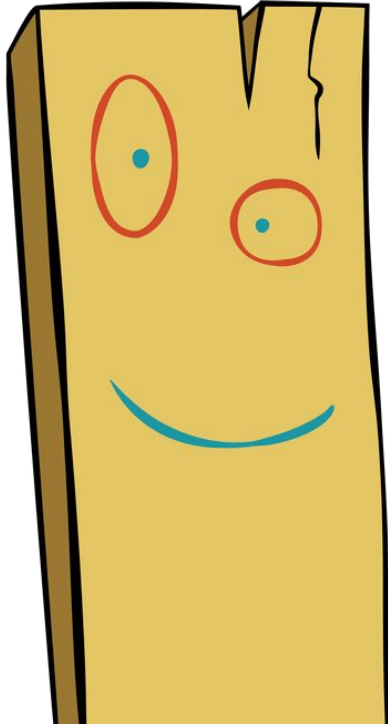


## SIMULATION

During the simulation phase, a node is selected randomly until a final state is reached.

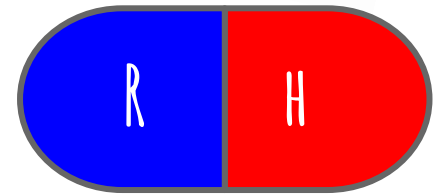
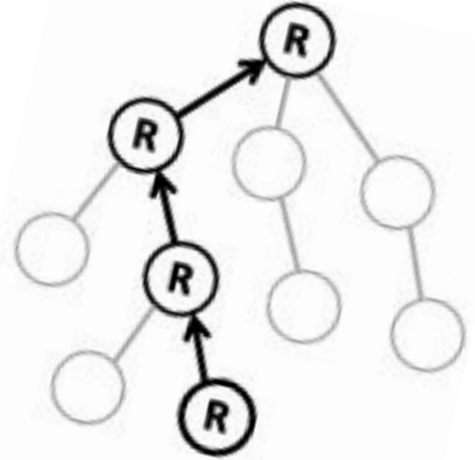


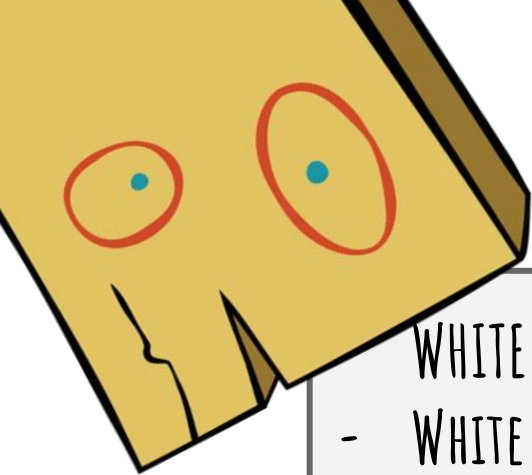
# MCTS + MINMAX



## BACKPROPAGATION

The reward of all the nodes in the path to the final state is updated, together with the heuristic value, according to the minmax logic. So that a Max node would update its heuristic value with the max of the values of the child nodes', and with the min for the Min nodes.





# HEURISTICS

## WHITE

- WHITE ALIVE
- BLACK EATEN
- WHITE WELL POSITIONED
- KING ESCAPES
- REMAINING TO SURROUND KING
- KING PROTECTION

## BLACK

- BLACK ALIVE
- WHITE EATEN
- BLACK SURROUNDING KING
- BLOCKED KING ESCAPES

# Questions?

